Government Intervention in Emerging Networked Technologies

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Some new technologies succeed, while others fail. Networks and multi-sided platforms are an important, but often-overlooked, explanation for these successes and failures. Many technologies will be successful only if their promoters can convince two (or more) sets of heterogeneous users to simultaneously embrace the technology. For example, in the case of credit cards, both consumers and merchants must decide to use the technology. For high definition (HD) televisions, both consumers and broadcasters must adopt the innovation. If only consumers adopted credit cards and HD, but merchants and broadcasters respectively did not, the technologies would fail: with no stores in which to use them, credit cards are as worthless (or perhaps even more so) than HD televisions that have no HD programming.

Because market success for many technologies requires coordination between different groups, there is a powerful incentive for innovators and entrepreneurs to get the government involved: government action, both direct and indirect, can strongly influence consumer and merchant behavior, and thereby ensure simultaneous adoption of the technology. Depending upon the situation, the government may (1) provide the information that allows individuals to coordinate their behavior; (2) pass legislation or adopt policies aimed at reducing concerns about a technology, (3) provide incentives to induce individuals to adopt new technologies, or (4) force change by eliminating or curtailing older technologies.

In this paper, we model how various groups decide whether to adopt and use networked and multi-platform technologies. We also explore when, if ever, the government should involve itself in influencing the success of such technologies. Drawing primarily on a rich set of examples from the payments industry, we conclude that the government generally should not intervene. First, technology moves fast and the government usually moves slowly. Second, with a bit of time, new technologies that are sufficiently advantageous are likely to flourish without government intervention. Third and finally, government interference may have the unintended consequence of dampening the incentive to invest in new technologies in the first instance.
Some innovative technologies catch on, while others fail. There is a temptation to view failures of new technologies as simply the operation of markets: good innovations will thrive and bad innovations will die. But in the real world, the stories of the success (or failure) of innovations are not always so simple, and adoption of new technologies is not always simply a matter of improved efficiencies. Seemingly superior technologies can fail in the marketplace for any number of reasons. Perhaps the most important of these is the need for social acceptance of the technology, particularly in markets characterized by network effects.

Network effects exist where the value of the product turns on how many others use it. One classic example of a market with network effects is the fax machine: such a machine is far more valuable when there are many other people using it than when an owner is one of only a few people with such a machine. Many modern technologies also have this same characteristic. High-definition (“HD”) television sets are only worthwhile to viewers if there are others broadcasting programs in HD. Consumers cannot use cell phones to make payments unless merchants adopt the technology to allow such payments. Because the value of the product to the user turns on whether other people use the product, social acceptance plays a large role in markets with network effects.

The network effect is even more complicated in what are known as multi-sided platforms: in these markets, the product is used by two different types of users, say Group A and Group B. The value of the product to users in Group A turns not on how many others are in Group A, but instead on how many are in Group B (and vice versa). HD
televisions and cell phone payments are multi-sided platforms, as are dating clubs like eHarmony. For the club to be successful, it needs both male and female members. In multi-sided platforms, as in other networks, social acceptance is crucial to the success of a new product. Here the challenge is more difficult, however, because the product can only succeed if adopted by groups on opposite sides of the platform.

Given the importance of getting others to buy into a new product, innovators have a strong incentive to take steps to obtain early adoption of a new technology. This problem is even more complicated in the case of multi-sided platforms, where innovators need to obtain adopters on both sides of the platform. There is an obvious incentive for providers of such new technologies to seek government support in their goal of obtaining social acceptance; this is no doubt even more true for products in which innovators have made large investments. If an entrepreneur can get the government to help ease the costs of adoption of the technology, or even mandate its acceptance, the problem of network effects can be minimized or even eliminated.

Governments, of course, will always intervene in markets. For our country’s entire history, government action—both direct and indirect—has affected what technologies will be adopted. Whether (and, if so, how and when) the government should intervene in a particular market is a tricky question.

In this paper, we use examples from the payment industry (and some others) to argue that the government usually should not intervene to aid new technologies. Payments provide a particularly rich lens through which to examine the question of government intervention. All payment systems are in essence a multi-sided platform. Even a gold or silver coin – what the Framers would have called specie – is of no value to a purchaser unless a seller is willing to exchange her goods or services for that coin. The United States government has long acted in ways designed to make us accept or reject certain kinds of payments. For example, although we consider federal reserve notes--dollar bills--a legitimate medium of exchange, for much of our nation’s history, consumers and merchants were reluctant to accept such notes and their predecessors, at least without a discount. As we will discuss, the government solved this problem during the Civil War by mandating that creditors accept United States notes.² Today section

² See infra notes 104-106 and accompanying text.
5103 of Title 31 provides that federal reserve notes “are legal tender for all debts, public charges, taxes, and dues.” As a result, all private and public creditors are required to accept federal currency in payment of debts, subject to a limitation of reasonableness for the time and means of payment.

The government also indirectly supports other payment systems. For example, extensive legislation and regulation supports the checking system. Articles 3 and 4 of the Uniform Commercial Code, along with an array of federal laws and regulations, set the basic terms for most check transactions, while the Federal Reserve itself has long acted as a cornerstone in the process of check collection. These kinds of government actions make checks more attractive to use. For both payments and other technologies, government support for the implementation of, or the infrastructure for, a particular technology may shift consumer choices toward that system.

Payments are also useful for examining the question of government intervention because, over the past few decades, the number of new products has been staggering. Not only have financial institutions introduced credit cards and debit cards, but also stored value cards, payroll cards, electronic money, electronic checks, and automated clearing house transactions, all of which have lessened the need for cash and checks. Now cell phone payments have become the subject of marketing experiments in places like Atlanta. In Japan, this technology is already used every day by hundreds of thousands of people. Other payment providers have begun to push systems that would operate through small electronic transmitters found on our key chains. Some providers have even begun to introduce payment through biometric devices that would identify payers through fingerprints or other physical characteristics. Some experts predict that cell phone payments alone will grow from $3.2 billion in 2003 to $37 billion in 2008.

Of course the open question is whether these new payment methods will become as ubiquitous as credit cards or whether they will go the way of the two-dollar bill. The

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4 See, e.g., Nemser v. New York City Trans. Auth., 530 N.Y.S.2d 493 (1988) (holding that, although the Transit Authority was required to accept payment of fares in United States currency, the Transit Authority could impose reasonable restrictions on when and where it would collect such currency and that, therefore, requiring the use of a token to pay a fare was permissible). In fact, the current understanding of the legal tender statute is that it applies only to pre-existing debts and that parties to an exchange need not agree to take cash.
answer depends on whether users can be convinced to adopt the new systems. For that to happen, the new systems must be both more profitable than existing systems for merchants and preferable over old systems to consumers. Many new technologies, when faced with network effects, are unable to satisfy both conditions. The crucial question we investigate is the conditions under, and the extent to which it is appropriate and possible, for the government to help tilt the scale in favor of new technologies.

We begin in Part I by describing and modeling how merchants and consumers decide whether to adopt and use a particular payment technology, and then introduce the complications of network effects and multi-sided platforms. In Part II, we describe the various roles that the government may assume vis-à-vis any new technology, including payment systems: legislator, fiduciary, or seller. Part III then discusses the tools that government has available to influence public preferences. Part IV argues that despite the availability of these tools, government generally should not act to promote particular technologies.

**Part I. Merchant and Consumer Preferences**

To decide whether and how the government should attempt to alter the choices that the public makes about new technologies, we must first consider how the public is likely to make such choices. As we discussed in the Introduction and show below, these choices are complicated by the problems of multi-sided platforms. For instance, merchants are much more likely to decide to adopt a new technology where a large number of consumers have shown a willingness to use that innovation, and consumers are much more likely to adopt the new technology when there are already a large number of merchants who have adopted it. This gives rise to the *chicken-or-the-egg problem.*

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6 In recent years, much literature has discussed satisfaction and maximization of preferences. Most of this discussion falls well outside the scope of this paper. For our present purposes, we accept that preferences are malleable.

7 This exists whenever payors and payees must adopt a new technology simultaneously for it to be successful, “otherwise there is little incentive for consumers or merchants to embrace the new instrument.” Sujit Chakravorti & Emery Kobar, *Why Invest in Payment Innovations*, Emerging Payments Occasional Papers Series, Federal Reserve Bank of Chicago, No. 2003-1B, at 7 n.12; see DAVID S. EVANS & RICHARD SCHMALENSEE, PAYING WITH PLASTIC xiii (2d ed. 2005).
unless both sides of the transaction can be convinced that they are better off with the new technology, it will not be adopted.

To show why this is so, we must present a model of how individuals make such decisions. To make this discussion more concrete, we will focus primarily on payment systems. As with other technologies, the decision to adopt and use a payment system occurs in two stages. In the first stage, the consumer and merchants must both choose to adopt a payment system (or other technology) as an option. In the second stage, the consumer must decide whether to use the new payment system.\(^8\)

**A. Merchant Decision-Making**

For ease of exposition, we start with the merchant’s decision to accept a particular technology. For a merchant, the question is whether adopting the technology will maximize profits.\(^9\) This should occur when the new technology allows the merchant to maximize its return on its investment. In the context of payments, this means that the merchant’s investment in a new payment system must exceed the return on other opportunities. As an example, consider the possibility that a restaurant owner has to choose between spending $100 on additional advertising or on adopting a credit card system, which will impose a 3% charge on credit card purchases.\(^10\)

The profit, \(P\), that the restaurant will make from the adoption of any particular payment system, \(X\), is a function of both the additional revenues that the system will generate, \(AR\), and the costs of the new system, \(C\), which can be further subdivided into two types: start-up costs, \(SC\), such as the initial fees to buy credit card processing terminals, and per transaction costs, \(TC\),\(^11\) such as the cost of a phone call by an employee to verify a credit card. This leads to the following profit function:

\[^8\] There are exceptions to this general rule that the choice of the particular payment system will be in the hands of the consumer. For instance, as a matter of practice, it is merchants rather than consumers who have the choice on whether to convert a check to an ACH payment. (For an explanation of ACH payments, see RONALD MANN & JANE WINN, ELECTRONIC COMMERCE (2d ed. 2005).)

\[^9\] FISHER, DORNBUSCH & SCHMAlENSEE, ECONOMICS 129 (2d ed. 1988)

\[^10\] We will treat the 3% fee as a discount on revenue rather than as an additional cost because the merchant never expends the fee; it is just a reduction in the payments the merchant receives from the credit card company.

\[^11\] By “per transaction costs,” we mean not just those costs that are charged on each particular transaction, but also those costs that are charged on a periodic basis, so long as the merchant continues to use the
\[ P(X) = AR - SC - TC. \]  \hspace{1cm} (1)

The owner should adopt a particular new payment system over an alternative technology, \( Y \), when the profit from the new system exceeds the profit from the old system. Because we are discussing alternative uses of the same investments, we can assume for our present purposes that the total costs of the two uses of the investment are the same. Therefore, the owner should adopt the new payment system when the additional revenues from the new payment system will exceed the additional revenues that would have been generated by an alternative use of the investment:

\[ AR(X) > AR(Y). \]  \hspace{1cm} (2)

In our example, now assume that the availability of credit cards will increase the restaurant’s business by $1000 and that the alternative investment in advertising will generate $950 in business.\(^\text{12}\) Finally, assume that the marginal cost of producing the additional food is zero. On this account, the restaurant owner should invest in the credit card system because the additional revenues from that system exceed the additional revenues from advertising, even after we account for the 3% fee paid to the credit card company.\(^\text{13}\)

Of course, the quantity of both the start-up and per transaction costs will still matter to any merchant’s decision on whether to adopt a new technology. That is because the larger those costs, the greater the additional revenues have to be in order to justify an investment in a payment system. If the start-up cost for our restaurant to adopt the new system was $200, instead of $100, and if $200 in additional advertising would generate...
$1500 in additional revenue, then it would be quite clear that the restaurant should invest in advertisement rather than a payment system.

In the real world, however, we believe that for many merchants the start-up costs for a new payment system are relatively small, and that therefore the additional revenue that has to be generated is also relatively small. For instance, a merchant who elects to start accepting charge cards has to pay almost nothing to buy the technology.¹⁴ Most of the costs for charge card acceptance consist of monthly maintenance and rental fees, which we categorize as per transaction costs.¹⁵ Thus, for merchants interested in a new payment system, the question is really whether the additional revenues of the new payment system, minus the per transaction costs, exceed the alternative profits that could have been generated by those same costs.

There are two final caveats we should mention. First, in many cases, a new payment system will not increase revenues to the same extent that it might initially appear. Returning again to our restaurant example, while the restaurant may generate an additional $1000 in business, it may also be that all of its consumers begin paying using credit cards. If so, the actual amount of additional revenue is only $820, and the restaurant should instead spend the money on advertising, which would generate $950 in revenue. This is obviously true of other technologies as well. For instance, broadcasters contemplating increased revenues from HD have to discount for decreased revenue from analog or other traditional broadcasts.

Second, and more importantly, we need to emphasize that not all of the costs and (perhaps) not all of the “revenue” may be financial or even quantifiable. For example, one such potential non-financial cost is the hassle cost associated with adopting and using any new technology.¹⁶ In the case of payment systems, merchants have to account for the

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¹⁴ Professor Ronald Mann estimates that the equipment costs are at most a few hundred dollars. See RONALD J. MANN, CHARGING AHEAD: THE GROWTH AND REGULATION OF PAYMENT CARD MARKETS (2006), at 30.

¹⁵ There are also, of course, the per-transaction fees, but as we noted above, see supra note 10, we view these as a discount on additional revenues, rather than as a cost.

¹⁶ See Dan Ariely & Jose Silva, The Macro-Effects of Micro-Pricing: Behavioral Effects of Payment Methods and the Effectiveness of Micro-Pricing, Working Paper, Mar. 30, 2005 (noting the existence of hassle). Hassle costs, as we are using the term, are similar to, but not the same as switching costs. See e.g., CARL SHAPIRO & HAL VARIAN, INFORMATION RULES 104 (1999). We are assuming here that investment in one payments system technology does not preclude investment in another such technology; therefore, no switch needs to be made.
time and effort that their employees have to spend learning a new payment system (a start-up hassle cost) and the time and effort they spend running a credit card through a reader and then printing out the receipt (a per transaction hassle cost). This investment of time and effort on the part of employees is a real cost to merchants, because they could have spent the time and effort on training employees to provide better service (in the case of the start-up cost) or on providing more timely delivery of another patron’s meal to her table (in the case of the per transaction cost).

More speculatively, a merchant may adopt a new technology not just because of the revenues that will result, but because of the status that she thinks it will bring her; in other words, the restaurant might start accepting credit cards because the owner wants to be seen as “high-end.” Similarly, a television network may begin broadcasting in HD not just because of additional revenues, but to be seen as “cutting edge.” This obviously requires a departure from the assumption of the merchant as a simple profit-maximizer, but we believe such a departure may be warranted for at least some subset of merchants. 17

B. Consumer Decisions to Adopt a Technology

Consumers’ decisions about whether to adopt a new technology (such as HD television or a payment system) into their respective portfolios of options ought to be similar, but not identical, to that of merchants. One difference is that consumers, unlike merchants, may not view the start-up costs associated with the adoption of a new technology as trivial, particularly when they are unfamiliar with it. Consider E-ZPass, a form of payment used on highways in the Northeast and the Midwest. In the E-ZPass system, a customer sets up an account with an E-ZPass member organization. Customers usually fund and periodically refill the account with a credit card, although some customers use cash or checks. Assuming that the account has money, the customer may pay her tolls on any E-ZPass participating highway by an automatic signal from a radio

17 At least one commentator suggested to us that a merchant may need to offer a credit card option, not to increase revenues, but to maintain revenues when competitors start to accept credit cards. We believe that this is a distinction without a difference. At any given time, the question for the restaurant is whether the additional revenues from adding a credit card option, discounted to present value, exceed the discounted additional revenues that would be generated from an alternative investment. When a merchant offers a credit card payment option to stave off defections by customers, this is additional revenue, because without the credit card option, there would be lower revenues in the future.
frequency identification ("RFID") transponder. Adopting E-ZPass involves a good deal of hassle start-up costs: the customer must fill out an application, mail it in or submit it on-line, receive back the RFID transponder, and then attach the transponder to the car.18 Furthermore, if the customer does not use a credit card, the funding of the E-ZPass account with cash or checks can involve some additional hassle costs.19

Just as a merchant seeks to maximize profits in its investment decisions, a consumer seeks to maximize her expected utility, which is a function of the benefits and costs of any particular decision she makes:

\[ EU(A) = B(A) - C(A) \]  

Assuming that A and B are alternative payment systems, a consumer should pick the new system, B, when the expected utility of that system exceeds the expected utility of the old system, A, such that:

\[ EU(B) - EU(A) > 0, \]  

Or

\[ B(B) - C(B) - (B(A) - C(A)) > 0 \]  

As we saw in the previous section, costs for payments systems consist of both the start-up costs and the per transaction costs. Furthermore, consumers need not adopt a new payment system for all transactions; a consumer can choose to obtain a credit card, but still pay for most transactions with cash or check. Therefore, what really matters to a consumer is whether there is some subset of transactions, \( i \), for which Equation (5) is true:

19 For consumers who pay by check, they must replenish the account by sending in a check in a timely fashion. For those consumers who have neither a credit card nor a checking account, they must make these payments either by money order or in cash at an E-ZPass facility.
\[ B_i(B) > B_i(A) + SC(B) + TC_i(B) - TC_i(A) \] ^{(6)}

Unlike benefits and per transaction costs, we do not limit start-up costs to those for \( i \) transactions, on the theory that the start-up costs are the same regardless of the size of the subset of transactions. For instance, the costs of obtaining a debit card are the same regardless of whether the consumer will use it only to get cash from an ATM or will use it for all of her purchases. In addition, we ignore the start-up costs associated with the pre-existing payment option, because those costs are sunk. However, as we will note below, in some circumstances sunk costs may play a role in decision-making about payment systems.

As an example, consider a consumer’s decision to obtain a new credit card. As with the E-ZPass example above, there will be some start-up hassle costs in obtaining the card, and perhaps even a small fee associated with the card. The real question for the consumer, given these start-up costs, is whether there is a set of transactions for which the consumer’s additional benefits from having the card exceed the additional costs of having the card:

\[ B_i(B) - TC_i(B) - B_i(A) + TC_i(A) > SC(B) \] ^{(7)}

Assume that in the past, the consumer has paid for her gasoline purchases using cash, but that her service station’s owner, whom we will call Gas Co., is offering her a credit card with which to purchase gasoline in the future. We will assume that the consumer receives no benefit from using cash and that the costs of obtaining cash are quite low.

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^20 Professors Jean-Charles Rochet and Jean Tirole hypothesize that a customer should purchase a payment card only if the expected benefit exceeds the expected fee. Jean-Charles Rochet & Jean Tirole, *Cooperation Among Competitors: Some Economics of Payment Card Associations*, 33 RAND J. Econ. 549, 553(2002). Our analysis here is similar, but with some modifications. First, we make clear the distinction between start-up costs for a system and per transaction costs, and we assume that the costs that really drive decision-making by consumers are not financial, but rather temporal and psychic. (Rochet and Tirole describe the fee as the “customer’s yearly fee,” id. at 553, and not as a per actual transaction fee, suggesting it is just meant to cover up-front fees). Second, our version recognizes that the benefit available to the consumer is limited to those circumstances where the benefits of a particular payment system are greater than those of other systems. In other words, the benefit that Rochet and Tirole identify can only be calculated as a net against the existing benefits from other payment systems.

^21 Admittedly, in theory we need to account for the lost opportunity cost on alternative investments of the start-up costs, as we did in Part I.A. We do not do so here because we believe that such costs are generally quite low.
Furthermore, there are no actual financial costs for using cash (because she has ready access to her bank’s ATMs, which charge her no fees) and that the marginal hassle cost of getting cash for such transactions is quite low: say the discounted present value of such costs is $100. Filling out the application and obtaining the card from Gas Co. involves no financial fee, but let us assume that there is a real hassle cost involved, and that this can be quantified as the equivalent of $50. Furthermore, we will assume that Gas Co. offers her no benefit from the use of the card, although the transaction costs are reduced to $75. On this account, the consumer ought to decline the card, because it results in an expected net decrease in her utility: \( SC(B) = 50 \), while \( B_i(B) - TC_i(B) - B_i(A) + TC_i(A) = 25 \).

To remedy this problem, Gas Co. might introduce a rebate program that gives the consumer 5% cash back on all purchases made with the Gas Co. card over a calendar year. If the discounted present value of that rebate is, say, $50, now the consumer should adopt the card, because the start-up costs ($50) are outweighed by the net gain on the other side of Equation 7: $75.

One difficulty with consumer decisions about new technologies is that many of the costs are nonquantifiable, such as hassle costs, and that consumers will tend to be quite heterogeneous in how they value these costs. Return again to our Gas Co. example. We hypothesized that the consumer faced lower transaction costs for a credit transaction than for a cash transaction. If such costs are limited to hassle costs, this may strike most readers as intuitively correct, because they pump their own gas and can pay with a credit card right at the pump, whereas cash payments may require going into an office, and may even require pre-payment. The assumption does not strike us as intuitively correct, however, because we both work in New Jersey, where we cannot pump our own gas, and payments with cash are both quicker and generally friendlier (particularly in winter, gas station attendants do not relish trudging back and forth with credit cards while we sign). A New Jersey consumer, therefore, may need a greater benefit to adopt the Gas Co. card than a consumer across the river in New York (where consumers pump their own gas). Furthermore, the willingness of New Jersey consumers to adopt the card will vary with

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22 Even assuming that the consumer can be sure that she will never pay credit fees for running a revolving balance on the card, she still has the hassle of making monthly payments to Gas Co. and any financial fees involved in make such payments, such as the purchase of additional checks, etc.
how much they disvalue the cost of paying with credit; some of us are simply less sensitive, both to the time loss and the unfriendliness of the attendants.\textsuperscript{23}

Another problem is that the nonquantifiable costs are, we believe, quite diverse. So far we have focused on the hassle of engaging in any particular transaction, but there are other potential costs. For instance, consumers might be concerned not just with the hassle of using a credit card, but with the potential loss of privacy as well. One “benefit” of cash transactions is that they generally leave no record, whereas credit card payments can generate a paper trail of exactly where a consumer has spent her money. For instance, a person who wants to hide certain transactions from a spouse has a powerful reason to pay cash rather than credit.\textsuperscript{24}

In addition, there is a risk of theft, both of money and of identity. When a consumer adopts cash as a payment system, she obviously takes on the risk that she will be robbed at some point and lose the cash in her possession. The risk of this type of theft is lower with the adoption of a credit card or even a debit card system: in both cases, a consumer’s liability for unauthorized transactions is capped both by statute and by card company practice. However, adoption of credit cards and debit cards may open up consumers to the possibility of identify theft, which can impose both financial and non-financial costs.

There is also the problem of sunk costs. As Professor Richard Thaler has noted, “only incremental costs and benefits \textit{should} affect decisionmaking.”\textsuperscript{25} But in reality, historical costs appear to affect the decisions that consumers make in the future. Consider again the consumer who has gone through the hassle of setting up an E-ZPass account and obtaining the RFID transponder. Once the consumer has E-ZPass, the hassle becomes a sunk cost that the consumer ought to ignore (as a normative matter) in making decisions about how she will pay for particular tolls.\textsuperscript{26} Indeed, the consumer will

\textsuperscript{23}The same observation can be made about HD television sets, where there may be costs in learning the new technology well enough to make the initial purchase, costs in setting up the set itself, and costs in obtaining HD service from a cable or dish provider. Again, all consumers will value these costs differently.

\textsuperscript{24}This remains true even in an age when cash transactions, to the extent they involve an ATM withdrawal, generate some form of record. It is a lot safer to pay $1000 for jewelry for your mistress using cash rather than using the credit card at Tiffany’s. Somewhat plausible stories for the $1000 withdrawal are easier to generate than stories about who received the jewelry.


\textsuperscript{26}See id.
inevitably encounter situations where the cash alternative is superior to E-ZPass, such as when the driver has coins readily available and the E-ZPass lines are longer than the others. But because ours is a positive model, we assume, in accord with the experimental evidence, that such sunk costs do affect consumer decisions about payment systems, such that previous costs incurred to obtain access to a payment system will make the consumer more likely to use the system.\textsuperscript{27} For instance, consumers who have paid for access to a charge card may be more willing to use that card in the future than they otherwise would be.\textsuperscript{28}

The benefits to consumers from various payment services can also be nonquantifiable and quite diverse. The most obvious examples of financial benefits to adopting a payment system are reward or affinity systems: either a small rebate on the purchase, or credit toward a reward (such as a free airline ticket).\textsuperscript{29} As for non-financial benefits, a consumer might value the ability of the payment system to generate a record of the transaction (the flip-side of our privacy cost point above). Prestige or social standing is another potential benefit of some payment systems. For instance, some people may pay with a “platinum” credit card instead of another credit card, not because the rate is cheaper or the hassle lower, but simply to gain the prestige that they believe is associated with having and using the card (the same is no doubt true of HD television sets).\textsuperscript{30} In other contexts, some consumers may wish to use a payment system to indicate that they are “tech-savvy.” For instance, when the New York City Transit Authority introduced the Metrocard, it believed that early users would be just such individuals.\textsuperscript{31} Of course, consumers may have completely idiosyncratic reasons for liking the older payment form. Think, for instance, of the 40-year-old who still eats Kraft Macaroni and

\textsuperscript{27} See id.
\textsuperscript{28} There are other transaction costs that may appear to be sunk costs but are not. For example, say that a consumer is deciding whether to pay in cash or write a check for a purchase. In order to write a check, the consumer would have first had to decide to purchase checks, which will necessarily have cost the consumer money. Although this prior purchase of checks might be seen as a sunk cost, it is not. The consumer will correctly intuit that writing a check brings her closer to having to buy more checks: the price of a check is properly a cost of writing one. This is actually (in our terminology) a per transaction cost for the consumer. See supra note 11 and accompanying text.
\textsuperscript{29} MANN, supra note 14, at 167.
\textsuperscript{31} See Matthew L. Wald, \textit{Fare Card Plan in the Subways Exceeds Goals}, N.Y. TIMES, Feb. 20, 1994, at 39 (noting that it was unclear if such people had actually adopted the Metrocard).
Cheese. We can be fairly certain that he would choose something else if he were tasting it for the first time, but the whole point is that the taste is not his first. As with food, familiarity and tradition may provide much of a payment system’s appeal. For example, checks have proven remarkably persistent despite the many electronic alternatives, particularly for payment from remote locations. The most common explanation for this persistence is that individuals are simply wedded to tradition.\(^\text{32}\) The comfort that comes from maintaining the tradition weighs in any decision to maintain the status quo.

Finally, because ours is a descriptive model, we focus in both this section and the next section on how consumers *actually perceive* the costs and benefits we are describing, not on the “real value” of these costs and benefits, even when they are easily quantifiable. For example, to the extent that consumers fail to account for some real costs—for instance, they may not take into account the full costs of using a credit card—we accordingly discount them.\(^\text{33}\)

**C. Consumer Decisions to Use a New Technology**

This brings us to the second-stage decision: the consumer’s choice among new technologies for a particular transaction. Our basic postulate is that a consumer will decide to use a new technology over an old technology where the expected utility from the new technology exceeds the utility that would be derived from using the old technology. This can again be seen by focusing on payment systems: a consumer will pick payment system B (say, a credit card) over payment system A (say, cash) for a particular transaction, \(j\), when the expected utility for using the credit card exceeds the expected utility of using cash. To calculate the expected utility of a particular payment system, consumers weigh the benefits and per transaction costs of the competing payment options, because the start-up costs for both systems are now sunk, such that system B should be selected over system A where:

\[ B_j(B) - TC_j(B) > B_j(A) - TC_j(A) \] (8)

The other main important conceptual difference between Equation 7 and Equation 8 is that, here, the consumer is selecting a new technology not on the anticipated benefits and costs for a hypothetical set of transactions, but instead for a particular transaction. In other words, at this stage the consumer (generally) will have better information about the actual value of the costs and benefits of a particular payment system.

As an example, return to a consumer’s choice to adopt the card from Gas Co. and now assume that our consumer lives in New York and works in New Jersey. In making the decision whether to adopt the credit card, she faces uncertainty as to where she is going to make her gasoline purchases. On the one hand, if she makes all of them in New York (where again she pumps her own gas), it makes sense to get the card, because the transaction costs for credit are less than the transaction costs for cash. On the other hand, if she makes all of her gasoline purchases in New Jersey, where we hypothesize that the transaction costs of credit outweigh the transaction costs of cash, then she should not adopt the card. For the consumer in this situation, what drives the decision about adoption is information about the likelihood of gasoline purchases in New York or New Jersey.

At the point of the decision to use the card, however, this uncertainty is obviously removed. If she is purchasing gasoline in New York, it makes sense to use the card, because the marginal benefits of using credit over cash likely outweigh the marginal transaction costs.\(^{34}\) If she is instead purchasing gasoline in New Jersey, the marginal costs of using the card may outweigh the benefits, so the consumer will not choose to use the card. The point is that at the time of the actual decision to use, the uncertainty has been removed.

**D. Network Effects and Multi-Sided Platforms**

\(^{34}\) This may not always be true, even in New York. The marginal benefits of use of the card, if they are limited to the rebate, are likely to be constant. The marginal transaction costs could, however, vary.
Up to this point, we have modeled the choices of consumers and merchants based upon an implicit assumption that the benefits and costs to the parties are independent of the choices made by other parties. But as we have noted above, that assumption is clearly wrong. Many new technologies such as payment systems and HD televisions are subject to network effects: the benefits to both consumers and merchants of adopting the innovation turn, in large part, on the willingness of other market participants to adopt or use that innovation.\(^{35}\) Consider again Equations 2 and 7. The decision by a merchant to invest in a new technology (Equation 2) depends directly upon the additional revenue to be generated by the system. For there to be additional revenue, there must be consumers who have both adopted the new system and who will use it if the merchants offer it. So if no potential customers of our hypothetical restaurant have adopted the credit card, nor are likely to do so, then the restaurant is unlikely to see any additional revenue, and it is fairly certain that an alternative investment would make sense. Similarly, if few broadcasters are providing programming in HD, then the value of an HD set is much lower than if all broadcasters are doing so.

A consumer’s decision to adopt a new technology (Equation 7) is similarly dependent upon merchant adoption of the system. The greater the number of transactions in which a new system can be used, the more likely it is that we can identify some subset of such transactions for which Equation 7 will be true. For instance, we suggested in our Gas Co. example that the use of a 5% rebate might be enough to get a consumer to adopt the card, depending upon the hassle costs, and we also hypothesized a scenario in which use of the card in New York made sense, but not in New Jersey. However, if not all Gas Co. stations take the card, or she also buys gasoline at the stations of other companies that do not accept the card, then her benefit from using the card will be lower, and perhaps insufficient to overcome the start-up costs of adopting the card. On the other hand, if she can use the card not just to make gasoline purchases at Gas Co., but also food purchases at Fast Food Co., then her benefits from the card may be even greater, making adoption of the card that much more likely. The point is that merchant decisions to adopt a

\(^{35}\) Of course, the decision to use the payment system is not dependent in this way upon the willingness of merchant’s to adopt the system: the ability to make a decision about use depends in the first instance upon the merchant’s decision to have adopted that payment system.
payment system increase the set of possible transactions in which the conditions of
Equation 7 for consumer adoption will be met.

Not only are new technologies subject to network effects, but they are also often
multi-sided platforms. David Evans and Richard Schmalensee define such markets as
having three basic characteristics: (1) there are at least two distinct types of customers for
the product; (2) there is some benefit to be obtained from coordinating members of the
groups; and (3) there is an intermediary that, through coordination, can make the
members of the groups better off. Examples of such multi-sided platform networks
include operating systems (which make both software developers and computer users
better off), television manufacturers (which make both broadcasters and viewers better
off), and payment systems (which have the potential to make both consumers and
merchants better off). Because they are multi-sided platforms, the benefits to a party of
the network do not depend upon the number of similar parties that are on the network, but
instead upon the number of parties there are on the other side of the platform. For
instance, a video game user traditionally did not care how many other players use a
particular gaming system; what she really cared about was how many video games were
developed for the system. Of course, sometimes the existence of other users on the
same side of the platform will be an additional benefit to a network, but the key to any
such network is having enough users on both sides of the platform. For instance, if your
colleagues are watching your favorite television show, water cooler talk might enhance
your enjoyment of it. But regardless of how much viewers enjoy a show, it will be
cancelled unless sufficient numbers of advertisers are interested in the program.

36 EVANS & SCHMALENSEE, supra note 7, at 134-35.
37 EVANS & SCHMALENSEE, supra note 7, at 136-38.
38 This may be less true now, as more gaming systems have remote multi-player games.
39 As a recent example, consider the demise of the CBS show Joan of Arcadia. While the show was
plagued by declining ratings, the real factor leading to cancellation in 2005 seems to have been the age of
its average viewer: 53.9. See Fans demand 'Joan', fight CBS over
cancellation, USA Today, May 30, 2005, available at
younger viewers.
A multi-sided platform network presents the *chicken-or-the-egg problem*:\(^{40}\) unless both sides of the transaction can be convinced that they are better off with the new payment system, it will not be adopted. And the presence of network effects means that the willingness of, say, consumers to adopt the new technology will depend on merchants also adopting it. The result, as commentators have noted in the context of payments, is that “[t]o gain critical mass in the marketplace, payment providers have to convince simultaneously a large number of participants of the benefits of new payment mechanisms.”\(^{41}\) Thus, the consumers and merchants whose behavior we model above are not isolated from each other; rather, a merchant considering whether to adopt a new technology considers whether consumers are likely to adopt the same technology, and vice versa.\(^{42}\)

**E. The Difficulty of Achieving a Critical Mass**

The rub, however, is that the groups on the opposite side of the platform are unlikely to be easily convinced that they have the same interest in adopting (and using) a new technology. As Equations 2 and 7 illustrate, the conditions under which consumers and merchants are likely to adopt a technology are often different. In the context of payment systems, we predict that a merchant will adopt a payment system whenever the additional revenues gained from adoption of the system outweigh the additional revenues that could be generated from another investment of those resources. For their part, consumers will adopt a new payment system only where the start-up costs for adopting the system are outweighed by the increase in net benefits and costs from moving to the new system for some set of transactions.

Not every new payment system, though, will satisfy both Equations 2 and 7. As an example, consider the introduction of stored value cards on the Upper West Side of

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\(^{40}\) This exists whenever payors and payees must adopt a new technology simultaneously for it to be successful, “otherwise there is little incentive for consumers or merchants to embrace the new instrument.” Chakravorti & Kobor, *supra* note 7, at 7 n.12; see EVANS & SCHMALENSEE, *supra* note 7, at xiii.

\(^{41}\) Chakravorti & Jankowski, *supra* note 32.

\(^{42}\) A recent example of this is the battle over the format for DVD players for high definition. The recent success of the Blu-ray format in obtaining the support of most movie studios of course makes the alternative HD DVD technology worthless to consumers. See Josh Levin, *I Am the Idiot Who Bought an HD-DVD Player*, Slate, available at http://www.slate.com/id/2185365.
New York City in the 1990s. The cards, which were rolled out by four leading financial institutions, failed spectacularly because only merchants, and not consumers, adopted them. In other words, Equation 2 for merchants appears to have been satisfied, but not Equation 7 for consumers. Merchants appear to have had quite limited start-up costs, which suggests that the additional revenues from the cards need not have been great for merchants to be willing to offer them. Furthermore, to the extent some consumers converted from cash to the use of the stored value cards, merchants presumably would have seen additional revenues in the form of a reduced risk of theft of the funds by robbers or employees.

Consumers, however, did not have adequate reason to adopt the card. The stored value cards were distributed as microchip-based smart cards placed onto debit cards, which were then sent by the banks involved to their customers who lived on the Upper West Side. In the existing payments universe at the time, stored value cards competed with cash and (to a lesser degree) debit cards. From the consumer’s perspective, it is hard to see any set of transactions in which the stored value card was better than either cash or a debit card. Consumers had to load the stored value card at an ATM, so the card involved just as much hassle as getting cash, and had no lowered costs or added benefits. Indeed, the cards were not safer than cash because, assuming a consumer was robbed of her cash, her cards were likely to be taken as well, and the stored value would be lost. Stored value cards also did not improve the consumer’s position as compared to debit cards, because both could be used for the same kind of transaction, and presumably most merchants who were wired to accept stored value cards would also accept debit cards. In

43 See Lisa Foderaro, A Test in Cashless Spending Turns Out to Be a Hard Sell, N.Y. TIMES (July 27, 1998) (quoting merchant as commenting, “It’s a dud. I have maybe three steady customers who use it, and they’re in the Hamptons now.”)
44 Id.
45 The experiment was initiated in 1997. At the time, debit cards were a fast-growing subset of payments, but still a fraction of what they are today. See FUMIKO HAYASHI ET AL., A GUIDE TO THE ATM AND DEBIT CARD INDUSTRIES 41-43 (2003), available at http://www.kc.frb.org/FRFS/ATMPaper.pdf.
46 Professor Leo van Hove suggests that stored value cards may be better for consumers than cash, because they do not have to worry about exact change; transaction time is similar; they do not have to carry a bulky wallet or purse containing bills and coins; and they may be able to reload the device at home, removing the need to go to a phone. Leo van Hove, Electronic Purses in Euroland: Why Do Penetration and Usage Rates Differ?, SUERF working papers (on file with author) (manuscript at 11-12). All of these benefits (except the last one), applied to the New York trial. Professor van Hove’s analysis (which was not aimed at the New York trial) ignores that, at least for an initial adopter, some of these benefits did not exist because not all merchants accepted the cards. Furthermore, to the extent cash had been downloaded to the card, it then became unavailable to use at cash-only merchants.
addition, debit cards, which required the use of a PIN, had additional security. The “cash back” feature of debit cards also allowed greater access to funds. In sum, no set of transactions existed for which consumers would prefer stored value cards. Thus, even if the start-up costs associated with the cards were quite low, consumers simply had no incentives to adopt them.

Despite the absence of benefits to one side of the transaction, a new technology can still thrive if the provider can internalize both some of the gains of one party and the costs of the other party, and thereby make adoption of the system more likely. One way to do this is for the platform provider to give a benefit to one side of the platform to stimulate adoption. For instance, in our Gas Co. example, we imagined the consumer being given a 5% rebate as a way of encouraging adoption. In the real world, similar examples exist. For instance, while general use stored value cards have not succeeded in the market, proprietary stored value cards have had more success. In such transactions, the merchant and the platform are the same entity (as they are in our Gas Co. example), and therefore the merchant/platform can internalize the costs to the consumers by directly offering other benefits to the consumer to entice use of the card. For instance, Starbucks has heavily promoted its Starbucks Card, which is a stored value card that consumers can use to make purchases in the store. Between October and the end of December 2005, consumers placed over 35% more value on Starbucks Cards than they had a year earlier.47 At first, such increased usage is perplexing, given that consumers can use cash or offline debit cards at most Starbucks locations. However, a large portion of the loaded value in the quarter represents money placed on gift cards: almost 75% of the value placed on the cards occurred in one of the three months–December.48 The question, of course, was whether individuals who received the gift cards would reload them with their own funds. To this end, Starbucks undertook an initiative to get consumers to use the Starbucks Card: it tied the Starbucks card to a credit card, the Duetto card. At the end of each month, the consumer automatically receives a reward in the amount of 1% of the purchases made on the Duetto credit card over that month.

48 Id.
Another complication for initiating a new technology is the fact we noted in Part I.B: the benefits from the use of the technology are more varied and they include potentially substantial non-financial benefits to a particular system. Furthermore, some of these benefits may tend to lock a consumer into an existing technology in a way that merchants are not locked in. In the Starbucks example we just used, some consumers may tend to continue using a store-branded stored value card out of loyalty: being seen by others as a regular Starbucks consumer may bring them some value. For many other consumers, though, there will be no such value to possession of the Starbucks card, and this consideration will play no role in their decision to use (or more likely not use) the card.

This heterogeneity in the value of technologies to consumers is a problem when it comes to gaining widespread acceptance of a particular innovation. Many of the benefits offered to entice one set of consumers will have no value to most other users. As a result, even if the providers of new technologies succeed in attracting a small number of consumers, they will not obtain a critical mass.

The history of charge and credit cards provides an example of this phenomenon.\(^49\) Charge cards, particularly the American Express card, experienced substantial growth through the 1950s, 60s and 70s. The overall penetration of charge cards nonetheless remained quite low by our present standards: by 1977, American Express (which was by this time the dominant pure charge card) had “merely” 8 million cardholders.\(^50\) Indeed, the peak penetration of charge cards into American households occurred in 1989, when 13% of Americans had such cards.\(^51\) The difficulty for charge cards was and is that their benefits as a payment system are limited.\(^52\)

Credit cards, by comparison, have experienced far greater market penetration. In 1970, the percentage of American households holding a credit card was only 16%—

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\(^49\) The term *charge card* means any card that permits the cardholder to make a payment using the card, with the amount charged to a third party, who then collects the funds from the cardholder. They are different from credit cards, in which the third party permits the cardholder to defer payment of the funds and instead allows the cardholder to finance the charge through a revolving line of credit.

\(^50\) *Evans & Schmalensee, supra* note 7 at 67.

\(^51\) *Id.* at 89.

\(^52\) Of course, we are not trying to suggest here that charge cards have been a failure. Charge cards continue to be an important part of the electronic payments universe. Our point is simply that, compared to credit cards – indeed, even compared to debit cards – charge cards have been relatively unsuccessful. This lack of success is particularly noteworthy given that charge cards existed before credit cards.
roughly the same percentage at which charge cards reached their peak. By 2001, the market penetration of credit cards had exploded to almost 73%. Credit cards have done so much better than charge cards over the last thirty-five years because they offer a wider range of benefits to consumers, leading to wider acceptance of the cards by merchants, which in turn has led to even more use by consumers.

What differences between charge cards and credit cards led to these wildly divergent outcomes? The most important is the ability of credit cards to extend a revolving line of credit to consumers. This is, in itself, a benefit that may often lead consumers to use a credit card over other options. Furthermore, changes in both technology and the law made it easier to offer revolving credit to consumers in the 1970s and 1980s. With the rise of computer technology and information processing, credit card issuers were better able to identify consumers who would be both interested in adopting a card and profitable for the payment provider. Furthermore, after the Supreme Court decided that local usury laws would generally not restrict the interest rates charged by credit card companies, it became profitable to lend to consumers who had previously been deemed too risky. The increased profits available from lines of credit then allowed credit card issuers to draw in other consumers through reward and affinity programs. The net result was a wide range of benefits that allowed credit cards to vastly increase their market share.

The importance of satisfying the heterogeneous interests of potential users raises a broader point about efficiency. Often an emerging technology will hold the promise of net financial gains for users on both sides of the platform. But if the innovator does not find a means of satisfying or overriding the disparate interests of potential users, the

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53 EVANS & SCHMALENSEE, supra note 7, at 89.
54 Id. at 89.
56 The actual holding in Marquette National Bank was that a “national bank” was only restricted by the usury laws of the state in which it was located, not by the laws of the state in which its customer was located. 439 U.S. at 301. The practical effect of the decision, though, was that most large banks legally resided in jurisdictions such as South Dakota and Delaware in which there were no caps on interest rates. See EVANS & SCHMALENSEE, supra note 7, at 69-70.
57 The same basic logic applies to merchants, of course. But because we assume that merchants, as a whole, are more driven by pure financial concerns in picking payments systems than consumers are, we assume that they are less heterogeneous than consumers. Having said that, there are certainly circumstances in which the benefits of a particular payment system are insufficiently attractive to particular merchants that at least one subset of merchants refuses to adopt the new payment system.
system will not be widely adopted. For example, because emerging payment forms often have lower service costs than their pre-existing competitors, improvements in payment systems can create clear economic benefits. But the market, left to itself, will not always adopt the most efficient system. That is, the technology with the lower service cost may not be able to obtain a critical mass of users, at least not in the absence of government intervention. The next Part describes the multiple hats that government may wear as it seeks to influence technologies.

**Part II. Governmental Roles**

When it comes to influencing our use of technology, the government can play three separate (and, in some cases, overlapping) roles. “Legislator” is the role that is most familiar; that is, government provides laws or regulations that make the social acceptance of a particular technology more likely. When the government acts purely in its law-making role, it has no direct stake in whether the technology thrives. Instead, it believes that society-at-large benefits from the technology, primary because of efficiency gains. For example, the United States government has long been interested in ensuring that adequate public airwaves are available for wireless telecommunications services. As we discuss below, it has taken regulatory measures to ensure this result. The government has done so not because it has a direct financial interest in the companies that sell wireless services, but rather because of the productivity gains that result from such services. Productivity gains are good for the economy, so the government has reason to legislate in ways that promote them.

In discrete areas of the economy—most notably transportation and mail—the government functions like a seller. Here the government either acts as the sole provider of a service whose practical requirements make it unattractive to private industry (like highway systems or large-scale public transportation), or the government competes with private companies that offer some overlapping services (as with the Postal Service and Federal Express). When the government acts as seller, it has a direct interest in whether its customers adopt particular technologies, as failure will adversely affect the bottom

58 See infra notes 115 -124 and accompanying text.
Finally, the government can act as a fiduciary or guardian of the public interest. For example, the now-familiar technologies of movies, television, and radio raised concerns about the suitability of some content for young or sensitive audiences. The government has acted to protect these interests in a variety of ways, such as adopting standards that limit the hours during which indecent or profane programming can appear, and pressuring the entertainment industry to adopt rating systems.

Payments are particularly useful for elucidating the various roles that government plays, because payments are an area in which the government acts as fiduciary, seller and law-maker. Government is probably most visible in its fiducial role, where it has two closely related goals: (1) to ensure that payees will accept coins and currency, and (2) to increase the demand for coins and currency by encouraging consumers to use new forms. These goals are intimately connected because if payees refuse particular coins and currency, then payors are unlikely to use them. For instance, the Treasury Department introduced new colors on the $20 bill in 2003, the $50 bill in 2004, and on the $10 bill in 2006. Between 1996 and 2000, the Treasury introduced updated versions of the $5, $10, $20, $50, and $100 bills. In support of many of these changes, the Treasury Department undertook substantial advertising campaigns to ensure both payee acceptance and payor use of the new bills. Less successfully, the Treasury Department has also attempted to gain support for dollar coins on several occasions.

While “fiduciary” is the government’s most well-known role with regard to payments, it is increasingly common for government to act as seller; that is, for the government to design a payment system for a service it purveys. Governmental agencies have long created payment systems for the collection of fares connected with both public and private transportation; in particular, they have encouraged and in some cases even required the use of tokens to pay fares both on toll roads and on buses and trains.

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electronic age, governmental agencies have put strong pressure on riders and drivers to cease paying fares and tolls in cash and instead to adopt new, electronic forms of payment. For instance, drivers all along the East Coast have been encouraged to adopt E-ZPass by the liberal use of discounts in tolls. Similarly, when the New York City Transportation Authority first introduced Metrocards, discounts were considered essential to obtaining consumer acceptance of the cards.

Finally, the government acts as law-maker with respect to various forms of payments. As we noted in the Introduction, complex legislation and regulation underlie the American checking system. In recent years, Congress has adopted legislation to make it easier for banks to exchange electronic copies of checks instead of physical hard copies. Of course, the government has only a small financial interest in the existence of a robust check collection system, and therefore little direct interest in whether substitute checks succeed or fail. When the government acts as seller, it has a much larger financial stake in the success of enterprises such as Metrocard and E-ZPass. The government’s interest in the checking system also is qualitatively different than when it acts as fiduciary: the acceptance of substitute checks is not vital to the continued functioning of the economy in the way that the acceptance of United States currency is.

But the government does have a general interest in payment systems. As we noted in Part I, some payment systems are more efficient than others. Efficiency is generally good for society, so the government has reason to promote it. The government might also have an interest in being responsive to the subjective preferences of consumers and merchants, even when these preferences are in tension with efficiency. After all, efficiency is not (nor should it be) the only criterion by which to judge

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66 Indeed, the Federal Reserve generally attempts to set its check collection fees so as to cover its associated costs. See [http://www.federalreserve.gov/Boarddocs/testimony/1997/970916a2.htm](http://www.federalreserve.gov/Boarddocs/testimony/1997/970916a2.htm) (last visited March 5, 2008).
governmental action. In the next Part, we assume that the government has a legitimate interest in changing endogenous preferences about technology in pursuit of efficiency and perhaps other goals. We thus proceed to examine and evaluate the tools government has at its disposal.

**Part III. Affecting Preferences and Network Effects**

Whether and how the government affects our technology preferences depends on the role that the government has assumed, its precise goal, and the particular sort of technology at issue. Depending on the situation, the government may (a) provide information that allows individuals to coordinate their behavior, (b) pass legislation or adopt policies aimed at reducing or eliminating concerns about a particular technology, (c) provide incentives to induce individuals to adopt a new technology, or (d) force change by eliminating or curtailing the older technology. The next section examines these options, each of which represents an incremental increase in the amount of pressure placed on potential users of the new technology.67

**A. Focal Points and Information**

As our earlier discussion of network effects suggested, most technology requires coordination. For instance, a business cannot send a fax unless the intended recipient also has a fax machine, and a man won’t have any luck using e-Harmony to find his future spouse unless women are also using the service. Payment systems require this sort of coordination: in order for a consumer transaction to occur, the seller needs to accept the payment form that the buyer tenders. The most innocuous means of facilitating coordination is for the government simply to provide information about different payment forms. For example, Check 21—the federal legislation that enables banks to return electronic copies of checks to their customers instead of physical hard copies—requires that electronic checks bear the legend, “This a legal copy of your check. You

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can use it the same way you would a regular check.” This sort of government action helps ensure that the public recognizes electronic copies of checks, and makes it easier for banks and those who use and receive checks to coordinate their behavior.

The ability to coordinate, however, by no means guarantees that a person will chose to use a particular technology. With payments, for example, informational efforts on the part of government should ensure that a seller accepts particular methods, at least when doing so requires no additional investment on the seller’s part. As a very simple example, a buyer may offer an updated $20 when purchasing groceries. If the seller does not know that the bill is legitimate, and the buyer does not have any alternative means of payment, the coordination failure could result in a lost sale. But if the government has informed the seller through advertising of the bill’s legitimacy, she is likely to accept it. Similarly, a seller who demands proof of payment is likely to accept a substitute check, provided she knows it is the legal equivalent of a traditional cancelled check. At the very least, then, government-supplied information helps ensure that individuals will accept one form of payment when they really prefer another.

As previously suggested, however, the success of a new payment form—or most technologies—depends on overcoming the chicken-or-the-egg problem. For payments, this means that not only do consumers have to be willing to adopt the new form, but merchants must be willing to accept it, which in turn depends on merchants anticipating that a sufficient number of users will be on the opposite side of the platform. Government-provided information may influence use when it emphasizes the benefits of one payment form relative to another. For instance, when the Mint launched the Sacagawea one-dollar coin, it purchased a commercial that featured a vending machine repeatedly rejecting a frustrated individual’s one-dollar bill. The Mint ultimately decided against it, but we can easily imagine how the commercial demonstrating Sacagawea’s consumer advantages would encourage use. That is, consumers would be initially attracted to the coin, vendors would anticipate this attraction, and consumers would similarly anticipate that vending machines would accept the coin. In other words,

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69 United States General Accounting Office, New Dollar Coin: Marketing Campaign Raised Public Awareness but not Widespread Use, at 21 (Sept. 2002) [hereinafter Marketing Campaign].
70 Some Treasury officials believed that there was an informal policy to avoid comparing the dollar coin to the dollar bill, or to otherwise negatively compare the two forms of payment. Id.
informational campaigns suggesting that one payment form is superior to another might influence network effects by both affecting the willingness of people to consider using the payment form in the first instance, and by influencing the predictions people make about the behavior of individuals on the other side of the platform.

Particularly when government is acting as fiduciary and seller, however, it may want to do more than just ensure use and acceptance of a technology. Instead, it might desire that a particular technology dominates. The government introduces the dollar coin, the Metrocard, or some other payment method because it sees an opportunity to increase efficiency and correspondingly reduce costs. As such, the government may try to make a particular technology the focal point around which individuals will voluntarily coordinate their behavior.71

As used in the economics literature, “focal point” refers to the place where individuals who need to coordinate their behavior gravitate. In Thomas Schelling’s famed example, for instance, two parachuters who are unexpectedly separated must find each other. Schelling illustrates how one point on their maps may be focal, or the place where each would expect the other to go in order to meet up.72 Richard McAdams uses Robert Sugden’s Crossroads game to illustrate how government speech can create focal points.73 In the Crossroads game, two cars approach an intersection on different roads. Both drivers prefer to maintain their respective speeds and have the other driver yield. Each driver’s paramount interest, however, is in avoiding the collision that would occur if they both maintained speed. McAdams discusses how the state can erect signs that, independent of any legal sanction, act as focal points that allow drivers to coordinate whether to yield or continue forward.74 Note that in both the parachuter and Crossroads examples, what is dominant or focal may not reflect an individual’s personal preference. That is, the parachuter who is many miles away from the focal bridge may prefer to meet elsewhere, just as the driver whom the sign instructs to yield would prefer to continue forward. In each example, however, the individual subverts his own subjective preference because the need to coordinate is paramount.

73 McAdams, supra note 71, at 1704-05.
74 Id. at 1706.
Government-provided information is most likely to create a focal point when the government is playing the role of either fiduciary or seller. Richard McAdams has posited that the law influences behavior because it creates expectations about how others will behave, and that people then coordinate their behavior around these expectations. McAdams argues that the law is particularly effective at creating focal points, because (a) new laws often receive publicity, which helps create expectations; (b) legal expression is unique, and thus stands out from competing expressions; and (c) legal officials have a reputation for correctly predicting future behavior. All of these factors make the legal message louder, and thus more focal, than alternative messages. While McAdams is careful to note that loudness does not depend on the morality that is often associated with the law, he concedes that the legitimacy of the law matters because it further helps distinguish the legal message from the rest. Similarly, when the government is wearing the hat of fiduciary or seller, the public is likely to perceive its message as having particular legitimacy.

Again take payments as an example. The United States government is universally perceived as the fiduciary of the national monetary system. As such, its words have special import when the message is about payment methods. While this is most obviously true when the message concerns United States coins and currency, the authority spills over to matters that are not directly connected to what constitutes legal tender. Moreover, the message should be highly salient when the government is selling a service like transportation; the message, after all, informs the buyer which sort of payment the seller prefers.

The Crossroads and parachuter examples, however, should illustrate the difficulty of convincing individuals to coordinate around a payment form, or any sort of technology that runs counter to their own preferences. Both examples offer only one opportunity to coordinate, which stands in stark contrast to the realities of many technologies. That is, the parachuters’ maps may show many possible meeting spots, but unless each parachuter

75 Id. at 1651.
76 Id. at 1666-71. As McAdams points out, this reputation is a byproduct of the publicity and uniqueness of the legal message. These two factors make the law an effective focal point. Legal officials may appear to simply be predicting future behavior, when in fact the law they promulgate actually shapes behavior. Id. at 1672.
77 Id. at 1670.
independently decides to go to the same place, they will not survive. Similarly, one driver has to yield and the other has to go, or else the cars will crash or indefinitely stall.

Many technologies, however, operate in areas that present myriad alternatives for coordination. For instance, most sellers will accept more than one form of payment; if a seller does accept only one form, it usually will be currency and coins, which everyone uses to some extent. Individuals can exchange a contract via fax, email, or the United States postal system. People can meet a prospective spouse on-line, at a bar, or at church. Increasingly, television shows can be viewed on standard television sets, HD sets and computer screens. Government-supplied information may influence expectations about how many users will be on the opposite side of the platform, and therefore may affect the willingness of parties on both side of the platform to adopt a particular technology. To illustrate, in equations (2) and (7), merchants and consumers are attempting to make predictions about the likelihood of increased utility from adopting the new system, and information supplied by the government about use by parties on the other side of the transaction can naturally alter these calculations. But information alone is unlikely to lead to increased use.\(^\text{78}\) When the customer chooses among the technologies she has already adopted, she knows which of her options the other side has adopted. Coordination thus is beside the point. The question, then, is what else the government can do to affect decisions to use a particular technology.

\(\text{B. Gently Addressing Particular Concerns}\)

Sometimes the refusal to use a new technology may result from a particular concern about one or more aspects of the new method. For example, as credit cards became increasingly popular in the 1960s, the possibility of theft and unauthorized charges received much the same kind of attention that identity theft receives today.\(^\text{79}\) Congress responded to this concern in 1970, when it amended the Truth in Lending Act

\(^{78}\) We acknowledge that focal point information may generate increased use through the mechanism of sunk costs: if the information provided led to the consumer adopting the payment system, those costs may become sunk costs that then lead the consumer to increase use of the system. See supra text accompanying notes 25-28. Otherwise, though, information about coordination should have no effect on decisions to use a system.

\(^{79}\) See e.g., He Who Steals My Purse Steals My Credit Cards, TIME (June 19, 1964) (available at www.time.com/time/archive/printout/0,23657,871192,00.html).
to provide that credit card holders are responsible for no more than $50 worth of fraudulent charges.\textsuperscript{80} At about the same time, Congress established specific criminal penalties for the fraudulent use of a credit card.\textsuperscript{81} As another example, in 1978, Congress noted that while “the use of electronic systems to transfer funds provides the potential for substantial benefits to consumers,” it was nonetheless problematic that the “rights and liabilities of consumers” were undefined.\textsuperscript{82} Thus, as part of its Electronic Funds Transfer Act, the federal government limited an account holder’s liability for unauthorized electronic fund transfers to $50.\textsuperscript{83}

In all of these examples, the government spoke to consumers in its legislative role. These statutes simultaneously reassure consumers and endorse the controversial technology. The statutes limiting liability directly address a source of consumer reticence by ensuring that the financial institution, not the consumer, bears the risk of fraud. The statutes thus actively and visibly eliminated one barrier to widespread use, and thereby underscored governmental support for the new payment system. As for the statute imposing criminal liability, it also sent a message to consumers: that the government took credit card theft seriously and was taking steps to prevent it. Some consumers may have believed that with a criminal statute in place specifically addressing credit card fraud, fewer individuals would engage in fraud in the first instance. All of these statutes, then, illustrate an approach in which the government behaves more proactively than when it simply provides information and attempts to create focal points around which individuals can coordinate.

In addition to addressing particular concerns about fraud, the statutes influence network effects, albeit gently. Because these statutes remove a barrier to use, they make both consumers and merchants more confident that a particular technology will become widespread. With this increasing confidence, more consumers, merchants, and institutions will invest in the new technology. Their actions will have a feedback effect: as others become aware of this investment, they too will adopt the new technology, and so forth.

\textsuperscript{80} 15 U.S.C § 1643.  
\textsuperscript{81} 15 U.S.C. § 1644.  
\textsuperscript{82} 15 U.S.C. § 1693.  
\textsuperscript{83} 15 U.S.C. § 1693g.
C. Providing Incentives or, Alternatively, Imposing Sanctions

Sometimes, however, no particularized concern animates an individual’s decision to eschew a new technology. Instead, the reticence is purely the result of the (perhaps irrational) preferences of individuals. When preferences are particularly strong, effective government action must make the benefits of the new technology either larger or more tangible, or, alternatively, must make the non-user internalize the cost that her preference imposes on third parties. In other words, effective governmental action must incentivize use of the new technology, or—depending on one’s perspective—sanction use of the old technology.

Such incentives can be quite effective. For example, Metrocard did not become popular with New York City subways riders until the transit authority offered free bus transfers to Metrocard users,\(^84\) and discounted tolls often contribute to a highway driver’s decision to use electronic payment. As another example, the federal government—which stands to gain millions by auctioning off public airwaves after television viewers switch from analog to digital technology\(^85\)—has started to offer $40 vouchers that can be used toward the purchase of digital converter boxes.\(^86\) Indirect incentives may be effective as well. For instance, highway authorities can increase the number of lanes dedicated to electronic payment and decrease the number dedicated to traditional payment; after such tinkering, non-electronic users will experience the “cost” of even longer lines. Indeed, some highway authorities have gone so far as to reserve certain freeway entrances to electronic payers. Each of these incentives, whether direct or indirect, magnifies the costs of sticking with the old payment method.

In all these examples of incentives, of course, the government is acting as seller. This is unsurprising, because incentives are often expensive, at least in the short-term. When the government is acting as seller, it may have good reason to internalize the costs of incentives, because the long-term benefits from a switch in technology will outweigh the short-term costs. The problem is that it may not always be possible to find a party to


\(^{85}\) See infra notes 115-124 and accompanying text.

internalize the network externalities of the new system, because the availability of profit opportunities may be limited. This is particularly true when the government is acting as fiduciary.

The story of the Susan B. Anthony dollar coin illustrates the difficulty. John Caskey and Simon St. Laurent have persuasively argued that the coin failed because the government did not understand the importance of network effects or the economic theory underlying coin/note substitutions.\(^\text{87}\) When the government launched the Susan B. Anthony in 1979, it was confident that the public would accept the coin and predicted widespread circulation within three to four years. The coin, however, was a colossal flop:

Despite the mint’s emphasis on designing a coin suitable for vending machines, most machines were not recalibrated to accept it. Vendors had begun updating their machines before the law passed, but as of 1979, only 250,000 of the four million vending machines had been updated. The cost per machine was $25 to $350 per machine, and given these costs, most vendors preferred to wait to see if the coin would become widely used before converting their machines . . .

At the same time, the media, public and retailers were criticizing the coins for looking like a quarter, making it hard to distinguish.\(^\text{88}\) Consumers complained about other features of the design, including color, reeded edge, and thickness. Because consumers did not want the coin, cashiers rarely offered it as change. Consumers declined to accept the coin from retailers as change, merchants returned the coin to banks, and banks, unable to distribute them and facing high storage costs, sent the coins back or did not reorder new ones.\(^\text{89}\)

By January 1980, only 291 of the 750 million coins produced were in circulation. In March 1980, the government altogether stopped production of the Susan B. Anthony dollar.

The obvious problem with the Susan B. Anthony coin was network externalities. Merchants who were deciding whether to accept the Susan B. Anthony were aware of the accompanying costs, which included retooing vending machines or creating space in the


\(^{88}\) This was a questionable criticism at best. The Susan B. Anthony was 43 percent heavier than a quarter, had the same size relation to the quarter as the quarter does to the nickel, and different engraving. *Id.* at 501.

\(^{89}\) *Id.* at 500.
cash register drawers and the risk that employees would confuse the coin with a quarter when counting money. From the merchant’s perspective, accepting the coin made sense only if a large number of consumers would be presenting the Susan B. Anthony and if the merchant was likely to lose sales if she did not accept the coin.

As we have discussed previously, however, consumers had an incentive to adopt the coin only if a sufficiently large enough number of transactions existed where the benefits of the coin overcame the costs imposed by adopting the coin. In this particular context, such situations were pretty limited. The main benefit of the coin was that it weighed less than the equivalent amount of quarters and would facilitate purchases in vending machines under then-existing technology. The costs came in two forms: first, the hassle of learning to identify the Susan B. Anthony as readily as other coins, and second, having to forgo transactions with vending machines or other merchants that did not yet accept the coin. Because at the beginning few vending machines accepted the coins, the costs here generally outweighed the benefits. The resulting equilibrium was such that neither merchants nor consumers had an incentive to begin using the coin, and unsurprisingly, the Susan B. Anthony dollar was a flop.

In contrast to the Susan B. Anthony, credit cards initially faced a similar challenge but managed to overcome it. As S.J. Liebowitz and Stephen Margolis have noted more generally as to network externalities, the failure to adopt a new, superior standard represents “a profit opportunity for someone who can figure out a means of internalizing the [network] externality and appropriating some of the value made available from changing to the superior standard.” In other words, in some cases, an entrepreneur who can innovate a way to profit from the creation of a platform will find ways to internalize the network externalities in order to facilitate adoption of the

90 See supra text accompanying notes 18-33.
91 Of course, this is a generality and does not speak to all consumers or vendors. It is plausible that for some consumers, the benefits of the coin outweighed its costs. This could be either because (a) they disproportionately had access to machines and merchants that accepted the coins and/or (b) they liked the coin—in other words, they obtained some sort of psychic benefit from having the coin. The existence of such a core of consumers will overcome the network externalities, however, only when it leads to what Professors Shapiro and Varian refer to as a virtuous cycle of positive feedback: a situation where other consumers and merchants adopt the product – here the coin – because they believe that others are also adopting the product. See SHAPIRO & VARIAN, supra note 16, at 173-77.
technology. An example of this again is the growth of both the charge card and the credit card industries over the past 50 years. In the first part of the story, charge cards went through a period of rapid growth following the creation of the Diners Club card because the founders of that card realized that they could make profits by extracting a high merchant discount fee (~7%) and giving the card to consumers at a fairly low cost (and a $5 annual fee). In other words, Diners Club, and then American Express, were able to internalize the costs of getting the cards into the hands of consumers by extracting higher profits from merchants.

In the second part of the story, credit cards became one of the dominant forms of payments in the United States when credit card issuers learned that they could make profits from the credit function of a credit card, which in turn allowed the company to offer the payment service of the card at a lower price. This bundling of products – the payment product and the credit product – was not enough, however. The second important innovation was the improvements in the revolving credit industry that allowed credit card issuers to make greater profits from the issuance of such credit. Essentially, this created what might be seen as a three-sided platform market, involving merchants and two types of consumers: those who are only transacting and those who are financing. Credit card issuers also became more sophisticated in the marketing of their credit product and in their ability to decide to whom they should extend credit and under what terms. These innovations allowed them to (mostly) eliminate annual fees, cut the costs charged to merchants, and expand the contexts in which such cards could be used. In other words, credit cards grew as a payment system because card issuers were able to extract more profits from consumers using the cards for financing services and thereby cut the costs of the cards to purely transacting parties, which led to more merchants accepting the cards.

93 See Evans & Schmalensee, supra note 7, at 136.
94 Evans & Schmalensee, supra note 7, at 54 & 59 (noting that the fee in 1958 dollars was $5). At the time, Diners Club earned roughly 70% of its revenues from merchants.
95 Id. at 150.
96 See Bar-Gill, supra note 33, at 1388-94 (describing methods card issuers use to market cards to consumers).
97 For instance, in the 1990s, Visa and Mastercard revoked their long-standing rules that credit cards could only be used in transactions in which the cards were physically present.
98 In their book, Evans and Schmalensee ignore this second story, we assume because they see the financing function as separate from the transacting function of credit cards. See, e.g., Evans &
The obvious question that arises, then, is why did the market not solve the problem for the Susan B. Anthony in the same way it did for credit cards? The answer, at least in the case of the Susan B. Anthony dollar, is that the profit opportunities for overcoming the network externalities were close to non-existent. There were no widely available additional products that could be bundled with the coin to underwrite its adoption. Moreover, the government – the supplier of this particular multi-sided platform – could not subsidize one side of the platform by extracting extra payments from another side. Of course, the government could have paid merchants and/or consumers to use the coin, but the complete absence of a discussion of that possibility in the literature suggests that it is beyond the pale.

The strategy adopted by the credit card issuers is not the only way for a party to try to overcome network externalities and promote a new technology. As Professors Shapiro and Varian point out, there are two basic ways to internalize switching costs. The first is to reduce those costs by making it easier to switch products. This was the method used by the charge card industry to get consumers to adopt the cards in the 1950s and 1960s. The second way is to increase the benefits available from the new network, thereby making the benefits of the switch outweigh its costs. Increased benefits may

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99 It is not impossible to imagine a hypothetical product that might do this. Say, for instance, that a vendor stood to make significantly more profits if consumers switched from using quarters to the coin. Imagine a soda company whose products are generally $1 (remember, this is just imaginary). Also suppose that the soda company, by fostering adoption of the Susan B. Anthony dollar, might save large amounts in the collection and transportation of coins from vending machines such that it is willing to give consumers a discount for purchasing with a dollar coin rather than with another assortment of change. Under these circumstances, the soda vendor’s decision might give consumers sufficient incentive to adopt the coin that it initiates a cycle of positive feedback, leading to widespread adoption of the coin, particularly if other vendors did the same thing.

100 In truth, the government already subsidizes all forms of currency in its role as fiduciary. See EVANS & SCHMALANSEE, supra note 7, at 30 (noting that “many of the costs of cash are hidden in the government’s budget”).

101 Professors Shapiro and Varian refer to these approaches as (a) the evolution strategy of compatibility and (b) the revolution strategy of compelling performance. SHAPIRO & VARIAN, supra note 16, at 190-91. They later clarify, though, that the evolution strategy “centers on reducing switching costs so that consumers can gradually try your new technology,” id. at 192, and that the revolution strategy focuses on “offer[ing] a product so much better than what people are using that enough users will bear the pain of switching to it,” id. at 195.
make a technology essentially irresistible to one side. For instance, restaurants and hotels accepted charge cards despite the quite high initial discount fees because the cards attracted additional well-heeled customers. Similarly, providers of DVDs have included all sorts of additional features on the discs to make them more attractive to consumers than the VHS tapes they replaced. Thus, in our example of the Susan B. Anthony coin, the government might still have succeeded if it was putting forth a product that had much greater benefits for both consumers and merchants. But in reality, the coin was not a radical improvement from the perspective of either group, and therefore was doomed to failure.

D. Withdrawing Alternative Technologies

When government is unable to provide strong incentives or the technology does not offer comparatively greater advantages for both consumers and merchants, it can ensure the success of a particular technology by eliminating or severely curtailing its competition. For instance, several G-7 countries have succeeded in introducing high-denomination coins by withdrawing the competing currency. As another example, the euro became the currency of European Union countries after each withdrew their national coins and notes, at a time when significant numbers of citizens across the 12 member countries would have preferred not to have the euro in the first instance. The United States itself has—for all practical purposes—eliminated competing payment forms at least twice in its history. The passage of the legal tender provision in 1862 meant that creditors had to accept greenbacks in satisfaction of a debt, even though they preferred to be paid in coin. Similarly, in 1863, the United States issued national bank

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Evans and Schmalensee similarly suggest that two ways to solve the problem are to cut the price for one side, perhaps to even pay that side for adoption, or to “invest in one side of the market.” EVANS & SCHMALENSEE, supra note 7, at 143. Obviously, cutting the financial costs, or even paying a party to adopt a new system, is a way to reduce the switching cost, whereas we see decisions to invest in the market as a way for a system supplier to offer a better product to that side of the market.

102 Marketing Campaign, supra note 96, at 20. These countries include Canada, the United Kingdom and Japan.


104 Gold quickly rose to a premium against greenbacks during the inflationary period of the Civil War, at one point reaching a high of 185 percent. Thus creditors who were forced to accept greenbacks received less than the market equivalent in other goods or monies. See generally Farley Grubb, The U.S.
notes, which faced stiff competition from state bank notes. Congress countered the competitive threat by placing a 10 percent tax on the issuance of the state notes.\textsuperscript{105} The 10 percent tax made issuance “virtually prohibitive” and the state bank notes quickly disappeared from circulation.\textsuperscript{106} As these examples illustrate, eliminating the competing payment system ensures that the new alternative will flourish; consumers and merchants simply have no choice but to use the alternative.

Withdrawning or severely curtailing the competing technology carries particular risks for the government. These sorts of actions are what the social norms literature calls “hard shoves.”\textsuperscript{107} That is, rather than using a series of incremental measures to gradually convince individuals about the merits of the new payment form, the government simply forces the public’s hand. When it comes to hard shoves, social norms literature has focused on the risk that individuals will react by either declining to follow or to enforce the law that is the subject of the hard shove. This in turn creates a “self-reinforcing wave of resistance” that solidifies whatever preferences the government is attempting to change.\textsuperscript{108} Once a government withdraws or severely curtails a technology, however, no self-reinforcing wave of resistance is possible. Individuals cannot insist on using the technology that the government has (for all practical purposes) eliminated. In effect, the government has achieved 100 percent compliance with and enforcement of its own preferences.

But while a government that uses heavy-handed measures to promote particular technology does not have to worry about preference backlash, it does have to concern itself with political consequences. This is the perfectly obvious observation that politicians are held accountable by their constituents. Former German chancellor Helmut Kohl, for instance, writes in his memoir that he forced the euro on the German people against their will and that they voted him out of office because of it.\textsuperscript{109} Similarly, many commentators believe that the Netherlands voted to reject the European Constitution in

\textsuperscript{105} HARRY D. HUTCHINSON, MONEY, BANKING, AND THE UNITED STATES ECONOMY 61-62 (4th ed.)
\textsuperscript{106} Id. at 62.
\textsuperscript{108} Id. at 608.
\textsuperscript{109} Helmut Kohl, MEIN TAGEBUCH 178 (2000)
part because of widespread dissatisfaction with the euro.\textsuperscript{110} As another example, in the next section we discuss Congressional efforts to replace analog television with digital. After the public failed to embrace digital TV, the government decided to legislate a date on which it would shut down the analog signal, thereby causing all TVs without digital technology to go black. As the blackout date approached and few Americans had adopted the requisite technology, Congress extended the date by three years.\textsuperscript{111} As one legislator put it, “If America’s TVs go black, we might as well all pack up and go home.”\textsuperscript{112} That is, hard shoves often come at a political price.

Governments engaging in hard shoves have the heavy burden of demonstrating that the promoted innovation genuinely benefits either the country as a whole or significant numbers of its citizens, or that the innovation is necessary to serve some larger purpose. The architects of the legal tender provision, for example, may have perceived it as necessary to preserve the solvency of big commercial banks, which would in turn allow for the sale of government bonds, which would in turn finance the Civil War.\textsuperscript{113} The European governments that adopted the euro believed a common currency would result in economic strength; in time, their citizens will learn whether these governments were right.

Because withdrawal or curtailment of a (popular) competing technology steamrolls over public preferences, it is the most heavy-handed measure that government can take. Whether the government is willing to use this strategy—or to instead choose one of the others outlined in this section—depends largely on whether it is acting as fiduciary, seller, or law-maker. Because every government entity would prefer not to anger or alienate its constituents, it seeks to spark change by the gentlest possible means. But when providing information or addressing particular concerns proves ineffective, government has to do more. As our discussion of the Susan B. Anthony illustrates,\textsuperscript{114} when government is acting as fiduciary, it lacks the profit opportunities that enable it to effectively incentivize use of the new payment form. Thus withdrawal or severe

\textsuperscript{110} Marlise Simons, \textit{Dutch Are Expected to Vote No on European Charter Today}, NY TIMES (June 1, 2005).
\textsuperscript{111} See infra notes 115-124 and accompanying text.
\textsuperscript{112} Anne Marie Squeo & Joe Flint, \textit{Move to Digital Pits TV Stations Against Cable}, THE WALL STREET J. (Feb. 10, 2005), at B4.
\textsuperscript{113} For an explanation of why the legal tender provision was advantageous for commercial banks, see Kenneth Dam, \textit{The Legal Tender Cases}, 1981 SUP. CT. REV. 367, 408-10.
\textsuperscript{114} See supra notes 87-91 and accompanying text.
curtailment of the competing form is the only available strategy. In contrast, when government is acting as seller, it will directly realize the cost-savings associated with a particular technology. This savings allows it to offer incentives aimed at overcoming strong individual preferences and network effects. Finally, when government is acting as law-maker, it is most likely to provide information and address particularized concerns, and leave the incentivizing to third-party institutions that stand to gain from the public making a switch. Moreover, when third-party institutions will be the biggest winners, politicians are likely to be most reticent about hard shoves that risk angering their constituents.


Although predicting what is on the horizon for new technologies is a tricky endeavor, we are confident that inventors will continue to create and that entrepreneurs will continue to bring those innovations to market. We are also confident that some of these innovators will seek government support. The critical question is whether the government should make this support available.

As Parts II and III illustrated, the government has a number of tools that it can use to promote the adoption and use of a particular technology. But government intervention tends be inadvisable for three reasons. First, technology moves quickly and the government (usually) moves slowly. As such, by the time the government intervenes, the “new” technology it seeks to support might already be on its way out. Second, with a bit of time, technologies that are sufficiently advantageous to the consumer are likely to flourish and thus governmental intervention is ultimately unnecessary. Third and finally, such intervention may have the unintended consequence of undermining the incentive to invest in new technologies in the first instance.

**A. Plodding Governments and Rapidly-Moving Technologies**

The United States’ 30-year long foray into digital TV illustrates the political process point. Terrestrial broadcasters (in contrast to cable and satellite providers)
traditionally have used an analog signal. Technology has existed since the 1980s that would allow terrestrial broadcasters to replace this analog signal with a digital one. The United States has always been acutely interested in this switch. With the passage of time some of the reasons for this interest have faded, but one continues to loom large: digital signal requires much less spectrum than analog. The liberated spectrum—or the freed-up public airwaves—will be auctioned off by the United States government, most likely for use in wireless telecommunications services. Digital TV thus promises to help raise vast sums of public dollars and ease the spectrum shortage that has emerged with the spread of wireless communications.

Since its creation, however, digital TV has faced the same sort of chicken-and-egg problem that the Susan B. Anthony and credit cards faced, albeit on a much more complicated scale. Digital TV requires the use of different equipment than analog, by the broadcasters who send the signal and in the televisions that receive it. The government initially thought that both consumers and broadcasters would readily make the switch, because doing so would allow consumers to watch television in high-definition (HD), which has substantially better picture quality than other alternatives. But before broadcasters can transmit in HD and consumers can watch it, networks have to produce shows in an HD format. Herein lies the problem, because

[n]etworks have balked at producing high-definition programming, arguing that there aren’t enough outlets that transmit such shows or enough viewers with the necessary technology to watch them. Local affiliates and viewers, meanwhile, have been reluctant to invest in the necessary technology, on the ground that there isn’t enough quality programming. And cable and satellite carriers, which already carry broadcaster’s analog programming, have been reluctant to provide additional space for the broadcaster’s digital programming, which often is a merely digitized version of their analog shows.

115 In the 1980s, the United States saw digital TV as a means to revitalize its consumer electronic industry and promote other high-tech industries. Hernan Galperin, NEW TELEVISION, OLD POLITICS 13-14 (2007)
In the 1990s, digital TV became part of “wide-reaching policy agenda” to “turn the TV set into a home gateway for digital services” in nations across the world. Id. at 14.
116 Id. at 15.
Furthermore, “TV-makers don’t want to want to push digital sets unless they know there’s enough programming to entice consumers to buy them.”

Because the United States government has an interest in auctioning freed-up spectrum, and because the Federal Communications Commission (FCC) regulates “who can broadcast what, to whom, at what prices, and using which technology, particularly in the terrestrial sector,” one might have expected the FCC to use a few hard shoves to speed the move to digital TV. In fact, however, government initiatives have been “either absent or ineffectual.” Most notably, legislation passed in 1997 set a deadline of December 31, 2006, for shutting down all analog television channels, but allowed a television station to receive an extension if fewer than 85 percent of households in its market had access to digital signals. By mid-2005, less than 4 percent of households had TVs that were capable of receiving such a signal. In February 2006, Congress acknowledged that the move to digital had floundered and passed new legislation that set a hard deadline of February 17, 2009, and provided up to two $40 coupons per household to be used towards the purchase of devices that convert analog signal to digital. Veteran observers, however, will be unsurprised if Congress once again backpedals as February 2009 nears.

The American experience with digital TV sharply contrasts with that of other countries, most notably the United Kingdom, where the transition to digital TV is nearly complete. Professor Hernan Galperin has identified a number of reasons why the United Kingdom was able to succeed where the United States has failed. Among them is a basic point about the American political system:

The organization of the state . . . militates against regime change and policy innovations. The system is devised to curb discretionary government behavior through structural division of power and formalized checks. . . . Such fragmentation offers organized interests a myriad of access points into policy-

118 Joel Brinkley, Digital TV Era Still Remains Out of Reach, NY TIMES (Aug. 7, 2000) at C1
119 Galperin, supra note 115, at 6.
120 Brinkley, supra note 118.
122 Id. at 33.
123 See generally Galperin, supra note 115, at 129-226 (describing the United Kingdom’s aggressive approach to digital TV).
making and each represents a potential veto . . . Gridlock and poor coordination are thus commonplace in American regulatory politics. This does not rule out the possibility of regime change, but such change is likely to be slow and politically contentious. 124

Because technology changes quickly, the American system may be particularly ill-equipped to meaningfully promote particular applications.

Check 21, the legislation that Congress passed in 2004 allowing banks to substitute electronic copies of checks for paper originals, is a case in point. This legislation aimed to tilt consumer preferences towards electronic checks in three ways. First, as with the legal tender statute, Check 21 overrides consumer preferences: even if a bank or consumer would prefer to receive the original check, they cannot insist upon it. 125

Second, the law provides a special procedure that allows a consumer to request a refund for any loss that occurs if a substitute check is incorrectly posted to her account. 126 Third and finally, Check 21 requires that electronic substitute checks contain the legend, “This a legal copy of your check. You can use it the same way you would use the original check.” 127 Check 21 therefore uses several of the tools discussed in Part III: it provides information, addresses particular concerns, and employs the hard shove of requiring the acceptance of substitute checks.

As a legal matter, of course, no law was necessary to allow banks to exchange electronic checks. Prior to the passage of Check 21, no statute said that banks had to present paper checks to other banks for collection. Even in the wake of Check 21, the law is silent on the form of technology used to exchange checks. All Check 21 provides is that banks can no longer require that the original check be returned to them; instead, they have to accept some sort of electronic substitute.

The legislation was aimed at remedying a variant on the classic network effects problem. Banks would not invest in the technology to allow electronic truncation because too few banks had adopted the technology. Presumably, given the billions of dollars that electronic truncation was expected to save the banking industry, the

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124 Id. at 256.
technology would have eventually caught on. But there was one additional complication: consumers who like receiving back their original checks. While banks, left to themselves, might have quickly migrated to electronic truncation, some banks were concerned they would lose customers if they, but not their competitors, switched to electronic truncation. The problem was thus that the entrenched preferences of some consumers gave banks little incentive to move to the new system, even though it promised large savings. Furthermore, at least at the time that Check 21 passed, no intermediary had emerged to internalize the switching costs.

Into this quagmire came Congress. In Check 21, the national legislature solved the problem of consumer preferences by applying what amounted to a hard shove. No matter where a consumer banked, she could not be guaranteed the return of her original checks, because her bank could not insist upon the return of the original from other financial institutions. In addition, through the use of the legend, Congress attempted to educate consumers about the legal status of electronic checks and their printouts. The key, however, was the hard shove.

What is complicated about this story is that the hard shove does not appear either necessary or successful. Even without Check 21, a significant percentage of check payments were likely to migrate to electronic payments as a result of accounts receivable check conversion (“ARC”). In the ARC process, a creditor takes a check written by a consumer to pay a bill and uses that check as an authorization to initiate an electronic direct debit from the consumer’s account (in other words, a payment flowing in the opposite direction of a direct deposit). Consumers are given some form of notice that the company will be engaging in the practice and the opportunity to opt-out, but very few do. In 2004, more than a billion checks were converted to ARC payments, and in 2005, the amount was over 1.6 billion. In addition, another 160 million checks were

128 One further complication was that in the two states in which Revised Articles 3 and 4 have not yet been adopted—New York and South Carolina—consumers retained a statutory right to receive their paper checks back.
130 Id.
converted to electronic payments at the point of sale in what are known as POP transactions. In these, the consumer presents a check to a merchant, who then uses the check to initiate a direct debit from the consumer’s checking account (using the bank routing number and the account number found on the bottom line of the check), and then returns the check to the consumer as a receipt. Given the explosive growth in such alternatives to check truncation, it is far from clear that Check 21 was necessary.

In fact, to date, the scant evidence suggests that Check 21 has been particularly unsuccessful. For instance, in a Federal Reserve Bank of Kansas City publication in April 2005, the authors conceded that widespread electronic clearing of checks had not yet occurred and that, under existing conditions, electronic truncation was *more expensive* than paper check processing. Another report by the Federal Reserve Bank of Chicago suggested that, nine months after passage, only 1% of the checks processed by the Federal Reserve Banks were substitute checks. Assuming this number is correct, only about 130 million checks were converted. That number obviously pales in comparison to the number of ARC transactions. To date, it seems that Congressional efforts to push electronic truncation have failed. Check 21 may have been of import when the legislation was first proposed, but by the time it actually passed, alternative technologies emerged that made electronic truncation far less important than banks had predicted.

132 MANN & WINN, supra note 8, at 559-60.
134 See Tara Rice, *Implementing the Check 21 Act: Potential risks facing banks*, 217 Chicago Fed Letter (Aug 2005) at 3. Apparently, the few checks that are presently converted are of particularly high value, for they account for 10% of the total value of checks. *Id.* This development is in itself somewhat disconcerting. As the author notes, banks are probably converting larger value checks, rather than lower value checks, because the bank can obtain “the float earned off the earlier availability of funds.” *Id.* Because the banks have no obligation to pass these savings on to customers, see *id.* at 4 n.5, Check 21 simply presents banks with an opportunity to gain additional profits with no improvement in services for customers.
135 A Wall Street Journal article suggests that Check 21 is facilitating the use of ATM machines that can create a digital image of a check, thereby enabling the consumer to use a “no envelope” deposit. There is no indication, however, that Congress foresaw this development, which underscores the point that the government is usually ill-suited to predict how technologies will develop. Robin Sidel & Ian McDonald, *The Envelope-Free ATM: Banks are Testing Versions to Read Checks, Count Cash; Twizzlers Wrapper is Rejected*, WALL STREET JOUR., May 8, 2006, at B1.
B. Advantageous Products Do Not Need Government Help

As Check 21 illustrates, the technology that government seeks to promote may be significantly less relevant by the time government actually acts. Another possibility is that the technology the government seeks to promote will remain important, so much so that it will eventually take off on its own, without governmental intervention. An example from Europe, again in the payments arena, helps illustrates this point.

A giro\textsuperscript{136} is the European equivalent of a check. Getting consumers and merchants to switch from paper-based transactions, such as checks or giros, to electronic payments over networks results in significant social economic benefits.\textsuperscript{137} As such, a switch to electronic payments is to a country’s economic advantage. In addition, we can assume that most merchants prefer electronic payment systems because they receive their money more quickly. But European countries vary widely in the extent to which electronic payments are made. For instance, in the Netherlands, the vast majority of non-cash payments are made by electronic “credit transfers” (essentially electronic giro payments).\textsuperscript{138} Such payments are rarer in Greece\textsuperscript{139} and Portugal.\textsuperscript{140} Instead, Greeks have continued to use checks and paper-based giros for the vast bulk of payments, and have adopted credit cards in large numbers for small-value transactions. In Portugal, the data suggests that checks, but not paper-based giros, compete with electronic giros for payments. These national differences are no doubt the result of both historical patterns of making payments as well as the price structure of various payment forms.

\footnotesize
\begin{itemize}
\item \textsuperscript{136} A giro is a transaction in which the consumer issues a directive to her bank to pay a particular creditor. It is frequently distinguished from a check as a “push” rather than a “pull” transaction: whereas a check requires the creditor to go to the consumer’s bank and request payment (i.e., pull funds from the consumer’s account), in a giro transaction, the money is sent to the creditor’s account as a result of the consumer directing her own bank to make the payment (i.e., the consumer has pushed funds from her account to that of the creditor). A giro transaction bears a great deal of similarity to the direct deposit transactions through which many employees are now paid.
\item \textsuperscript{137} David Humphrey et al., Benefits from a changing payment technology in European banking, ___ J. Banking & Fin. ___ (forthcoming 2007) (manuscript at 2) (suggesting possible savings of up to 1% of national GDP, and documenting average savings of 0.38% of national GDP).
\item \textsuperscript{139} Id. at 155-56 (7.5% of payments and 12% of value of payments in 2004).
\item \textsuperscript{140} Id. at 271-72 (6% of payments and 54% of value of payments in 2004).
\end{itemize}
With regard to the price structure of payments, the story is familiar: banks expect that consumers will respond to price incentives; that is, banks anticipate that consumers will use electronic alternatives if they are cheaper than the paper equivalent. But consumers rarely pay directly for such services; instead they pay indirectly, through the loss of the “float” on paper checks or through lower interest on account balances. No bank wants to be the first (and possibly only) institution to start directly charging customers for services they had perceived as free. Again, the issue is a variant of the classic network effects problem. So how can one country make the switch more quickly than the other?

Between 1990 and 2004, Norway and the Netherlands experienced significant changes in the way that consumers paid for point-of-sale transactions. Electronic payments, however, took off more quickly in Norway than in the Netherlands. This is because, in Norway, customers were charged a per-transaction fee for their use of both electronic and paper payment systems, with the electronic generally cheaper. Norwegian banks were able to overcome the risk of losing customers by coordinating the timing of when per-transaction fees would begin. While ordinarily this sort of collusion would draw the attention of antitrust officials, they decided to do nothing to prevent it. Per-transaction fees were also encouraged by Norway’s central bank. Not surprisingly, Norwegian consumers reacted to the price incentive by moving away from the old system to the new.

But while change did not happen quite as rapidly in the Netherlands as in Norway, it still occurred. In other words, even without a price incentive and the coordination that made the incentive possible, Dutch consumers eventually adopted the new payment systems. For instance, per person use of electronic giro payments in Norway grew 12% annually between 1990 and 2004; per person use of electronic giro payments grew 7% annually in the Netherlands during the same time period. But in

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142 Id. at 3.
143 Id. at 2.
144 Id. at 2.
145 The banks did not coordinate the amount of per-transaction fees, which could be zero.
146 Id. at 5.
both countries, paper checks had almost entirely disappeared by 2004. Dutch and Norwegian consumers had replaced them with electronic giros payments, debit cards, and cash that was usually withdrawn through an ATM.¹⁴⁷

A comparison of Norway and the Netherlands, then, suggests that sometimes the technology the government seeks to promote would have taken off without any legislative push, particularly if the technology is sufficiently advantageous to consumers and merchants. If the legislation prompts no change beyond what the market would have accomplished in its own time, then legislative resources are better spent elsewhere.

C. Stifling Competition

There is a third reason why government should not act to promote particular technologies: the possibility that intervention will stifle competition in the industry and thereby decrease innovation and the offering of special incentives. When it comes to technology, market competition leads to useful innovation. For example, although the United States has not yet been able to switch from analog to digital, it did win the race to create the first digital TV system. This success stems from the approach the United States took towards the technology: rather than mandate an HDTV standard like many of its industrial counterparts did, the United States took a more flexible approach that promoted research into new ways of compressing HD signals.¹⁴⁸ When the government legislates, there is a risk that it will do so in ways that decrease innovation.

Consider the market for payments by cell phone. Providers are immensely interested in convincing consumers to use their cell phones to make payments and have begun to experiment with such services, which have already taken hold in parts of Asia.¹⁴⁹ But interoperability (or a lack thereof) could prevent consumers from migrating toward cell phone payments. Issues could arise at two different levels. First, different cell phone companies may develop different technologies, with the result that only some cell phones will work in one location to make a payment, while other cell phones will work in another location. Second, cell phone companies may differ in what payment

¹⁴⁷ Id. at 3-4.
¹⁴⁸ Galperin, supra note 115 at 246.
¹⁴⁹ A Cash Call, supra note 5, at 71-73.
services they are willing to offer to customers. One company might allow its customers to select among accounts from which to make payments, while another company may require that customers only make payments through a credit card, perhaps even a particular bank’s credit card. Hence the most likely request from payment providers is that the government require operators of new payment systems to increase interoperability.

Just as the Federal Reserve and banking interests sought congressional aid in mandating the acceptance of substitute checks, payments industry parties may seek assistance in gaining acceptance of a particular cell phone technology. In Hong Kong, for instance, nearly 95 percent carry the Octopus card, which is a stored value card that (like E-ZPass) uses RFID technology.\(^\text{150}\) One of the main factors in the phenomenal success of the Octopus Card was the formation of a joint venture by the five largest public transportation providers to support the creation of a card that would work on all of their lines.\(^\text{151}\) Similarly, the success of smart cards\(^\text{152}\) in Europe has been tied to the willingness of state telephone companies to mandate their adoption for pay phones.\(^\text{153}\) For cell phone payment schemes to work in the United States, interoperability is also likely to be crucial; only interoperability will allow sufficient benefits to satisfy the heterogeneous preferences of a critical mass of consumers, which will in turn induce merchants to accept cell phone payments.

One quick means of increasing the possibility of a critical mass is for the government to mandate a particular technology.\(^\text{154}\) Such a move would, of course, limit consumer choice among possible products. For instance, Cingular has tested a product in Atlanta that uses special RFID chips in cell phone handset covers to allow customers to

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\(^\text{150}\) See Carol L. Clark, Shopping without cash: The emergence of the e-purse, Economic Perspectives, at 34, 36 (4th Quarter 2005).

\(^\text{151}\) Id. at 37. In contrast, Carol Clark notes that two similar systems launched by competing companies in Macau failed to succeed because of the lack of interoperability. Id.

\(^\text{152}\) A “smart card” generally refers to any payment card that has a microchip embedded in the card that contains information. In Europe, one of the primary uses of smart card technology has been to allow the embedding of a PIN on a microchip located on a credit card, which the consumer confirms when she makes a purchase with the card

\(^\text{153}\) Shapiro & Varian, supra note 16, at 244.

\(^\text{154}\) Note that the other possibilities for government action we discussed in Part III are unlikely to be useful in this context.
make payments at Philips Arena. In this product, the chip connects the cell phone with the customer’s “existing Chase credit card accounts.” Paypal encourages consumers to use their cell phones to send money from their Paypal accounts to friends and relatives. A similar product is Obopay, which provides consumers with software that allows them to receive and make various payments via their phone. (In the Obopay system, the phone itself is not used to make retail payments; instead, the consumer uses a special debit card that is linked to the Obopay account.) One possibility is that smaller existing payment providers will pressure the government to ensure that these new services provide access to not just particular accounts, but to all of a consumer’s credit and/or deposit accounts. On its face, such governmental intervention is appealing, for it would make such products attractive to a wider variety of consumers and thereby increase the likelihood of adoption.

The rub is that the success of such systems is likely to require not just attractive services, but also the use of incentives. For example, Obopay presently gives new users $10 in their account just for signing up. Incentives are costs, and those costs need to be internalized by someone. The most likely parties are existing payment providers. And if those providers are not guaranteed exclusive access to customers, they may fail to invest in the first place. In this context, then, government interference, far from increasing consumer choice, may actually undermine it.

Moreover, the stronger the governmental shove towards a particular technology, the greater the risk that the government will stifle competition within the industry. For example, because cell phone payments currently are not a necessity, there is competitive pressure for payment providers to entice consumers and merchants with special incentives and services. Payment providers also have an incentive to continue to develop

156 Id.
157 Id.
158 For information on the service, see https://www.paypal.com/us/cgi-bin/webscr?cmd=xpt/mobile/MobileSend-outside (last visited November 30, 2007)
160 Id.
159 Id.
158 Cf. Dash & Belson, supra note 155, at C4 (noting that big card issuers would prefer to limit access to accounts).
161 See also Clark, supra note 150, at 43 (noting the importance of incentives).
new technologies that expand the appeal of their products. Any governmental action that forces a particular technology upon consumers and merchants is likely to cut off these sorts of innovations and incentives because they will no longer be necessary to ensure widespread use adoption and use of the technology. The potential for stifling competition, then, is another reason why government should rarely intervene to promote a new technology.

**Conclusion**

In a digital world, the number of networked technologies will increase dramatically. Beyond the examples we discuss in this paper, there are operating systems for computers and other devices and network standards for cell phones, to name just a few. The success of such technologies will turn on the ability of their promoters to gain adoptions from a wide variety of users. Given the large investments at stake, there is likely to be a great deal of pressure for the government to take a role in assisting or even promoting particular technologies.

As we have argued, however, the government generally should do nothing. Market participants are usually better-positioned than the government to bring about the needed coordination for a technology to succeed. Even when the market may have trouble coordinating for a particular technology, there is still good reason to be skeptical that the government will decide to invest in the right technology, or move in a timely enough fashion, or act without causing collateral damage.

None of this is to say that the government should have no role. Clearly, providing support in the form of legislation that clarifies the rules for already-dominant technologies can create additional efficiencies for society. But even here, the government must be careful that it does not prop up failing technologies (for example, electronic checks) at a time when more efficient technologies (for example, direct deposits and withdrawals) are taking over. Government power can just as easily distort the market by entrenching an old and failing technology as it can aid the adoption of a new technology. As this article is going to press, newspapers are reporting that many Americans are abandoning traditional television sets for programming that is streamed to their computer
screens. This news comes just shy of a year in advance of the government-engineered digital TV revolution. Hindsight is always 20 – 20, but the accompanying lessons are should also be clear: government usually is not well-suited to help the public decide which technologies should take off and which should fail.

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